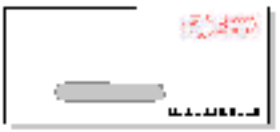
The Environmental Impacts of Standard (A) Mail



The Environmental Impacts of Standard (A) Mail

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ES.0 EXECUTIVE SUMMARY

In 1993, the United States Postal Service (USPS) initiated an effort to integrate environmental decision making into daily operations. As part of this effort, the USPS drafted an Environmental Strategic Plan and formed a "Greening of the Mail" task force -- a partnership with several public and private organizations aimed at improving environmental performance and informing the debate over the environmental impact of mail. Despite the efforts of the Postal Service to improve environmental performance, some environmental organizations and competitors of the Postal Service have raised issues questioning the impact of bulk advertising or direct mail on the environment. This study analyzes the environmental costs and benefits of direct mail. Our analysis indicates that the environmental benefits of direct mail, although hard to quantify precisely, are far greater than the costs.

To set a context for the discussion of environmental costs and benefits, we begin with a discussion of the composition of direct mail. The majority of direct mail is mailed at Standard (A) rates (previously referred to as Third-Class rates). This class of mail accounted for over 39 percent of 1996 mail volume and has grown rapidly in this decade. The majority of Standard (A) mail consists of advertisements from mail order companies, publishers, department stores, and financial institutions.

To quantify the environmental cost of direct mail, we assess the waste management costs that arise when individuals dispose of it, causing direct mail to enter the municipal solid waste (MSW) stream. Our analysis indicates that these costs are relatively small. Standard (A) mail accounts for only 2 percent of MSW generation, far less than other waste types such as plastics, metals, food wastes, glass, and other paper/paperboard products. Using this method, the environmental cost of direct mail is approximately $125 million per year, or less than 0.2 cents per piece of mail. If current trends continue – the Standard (A) mail recovery (recycling and composting) rate has increased rapidly in the nineties – this cost may drop in the future.

To quantify the environmental benefits of direct mail, we focus on the reduction in automobile trips resulting from individuals shopping at home. Direct orders from catalogs replace shopping trips typically made in automobiles, thus reducing the number of traffic accidents, the amount of pollution emitted by automobiles, and the amount of gasoline consumed by individuals. We estimate the value of these environmental benefits at approximately $400 million annually, much higher than the environmental cost of $126 million. Table 1 provides additional detail on the environmental costs and benefits associated with direct mail.

Table 1. Environmental Costs and Benefits of Direct Mail ($Millions)

Source	Cost	Benefit
Waste Management Costs	$126	
Reduced Traffic Accidents		$252
Reduced Automobile Emissions		$65
Reduced Gasoline Consumption		$81
Total	**$126**	**$398**

Although further analysis of consumer behavior would allow a more precise estimation of direct mail's environmental costs and benefits, under most reasonable assumptions, the environmental benefits still outweigh the costs.

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1.0 INTRODUCTION

In 1993, the United States Postal Service (USPS) initiated an effort to integrate environmental decision making into daily operations. As part of this effort, the USPS drafted an Environmental Strategic Plan and formulated seven guiding principles for the Postal Service:

- Meet or exceed all applicable environmental laws and regulations;
- Incorporate environmental considerations into business planning processes;
- Foster the sustainable use of natural resources;
- Expect employees to take ownership and responsibility for environmental objectives;
- Work with customers to address mutual environmental concerns;
- Measure progress in protecting the environment; and
- Encourage suppliers, vendors, and contractors to comply with similar environmental protection policies.

To respond to public concerns, the USPS formed the "Greening of the Mail" task force in 1996. The "Greening of the Mail" is a public-private partnership with the Environmental Protection Agency (EPA); Office of the Federal Environmental Executive; Direct Marketing Association; Advo, Inc.; U.S. Conference of Mayors; Texas General Land Office; and the American Forest and Paper Association. The objectives of this task force are to identify new business opportunities, increase recycling, and inform the debate about the environmental impact of mail.

Notwithstanding the efforts of the Postal Service to improve environmental performance, some environmental organizations and competitors of the Postal Service have raised questions about the impact of bulk advertising or direct mail on the environment. The Postal Service determined that it was important to inform the discussion on the environmental impacts of mail through a systematic analysis of the environmental costs and benefits of direct mail. To perform the analysis, they retained Project Performance Corporation (PPC) to assess the environmental impact of direct mail. Our review focused on the cost of managing the waste from direct mail and the environmental benefit of the reduction in the number of automobile trips from those who "shop at home."

Based upon our review of publicly available data primarily from EPA and the National Highway Transportation Safety Administration (NHTSA), we found that the environmental benefits of direct mail, although hard to quantify precisely, appear to be far greater than the costs. The remainder of this report provides more detail on this finding:

- **Section 2** describes the composition of direct mail.

- **Section 3** presents the magnitude of the waste resulting from direct mail and the associated disposal costs.

- **Section 4** quantifies and monetizes the environmental benefits of direct mail, which are high although hard to quantify precisely.

- **Section 5** compares the environmental costs and benefits of direct mail and finds that the benefits are far larger than the costs under most reasonable sets of assumptions.

2.0 COMPOSITION OF DIRECT MAIL

Direct mail refers to "all direct response advertising communications through mail or other delivery services" including catalogs, cards, letters, and brochures (WEFA 1996). The majority of direct mail that is delivered by the Postal Service is mailed at Standard (A) rates (previously referred to as Third-Class rates). For this reason, our analysis focuses on Standard (A) mail and we use the terms Standard (A) mail and direct mail interchangeably. This section describes the magnitude and composition of the Standard (A) mail stream:

- Standard (A) mail is a large and growing portion of total Postal Service mail volume.
- The majority of Standard (A) mail consists of advertisements from mail order companies, publishers, department stores, and financial institutions.
- In general, Standard (A) mail is targeted, received favorably, and found to be useful by recipients.

Sections 2.1 through 2.3 discuss these findings in greater detail.

2.1. STANDARD (A) MAIL VOLUMES

Standard (A) mail is a large and growing portion of the mail stream. In 1996, businesses and nonprofit organizations mailed approximately 72 billion pieces, or 4.5 million tons, of Standard (A) mail. About 80 percent of these pieces were mailed at commercial rates and 20 percent at nonprofit rates. In 1996, Standard (A) accounted for approximately 39 percent of the 183 billion pieces of mail delivered by the Postal Service. Exhibit 2.1 compares the volume of Standard (A) mail to that of other classes of mail (USPS 1996a).

Exhibit 2.1. FY 1996 Mail Volumes by Class of Mail

Class of Mail	Volume (Billions of Pieces)	Percentage of Total Volume
First-Class	98.2	52.5%
Standard (A)	71.7	39.1%
Periodicals	10.1	5.5%
Other	3.4	1.9%
Total	**183.4**	**100.0%**

While First-Class Mail is the largest class of mail, Standard (A) mail volumes have recently increased at a faster rate than First-Class Mail volumes. From 1992 to 1996, First-Class Mail volumes increased by only 2 percent per year, while

Standard (A) mail volumes grew 3.65 percent annually over the same period. Exhibit 2.2 shows the growth in Standard (A) and First-Class Mail volumes from 1992 to 1996 and provides a projection of 1997 volumes (USPS 1996a).

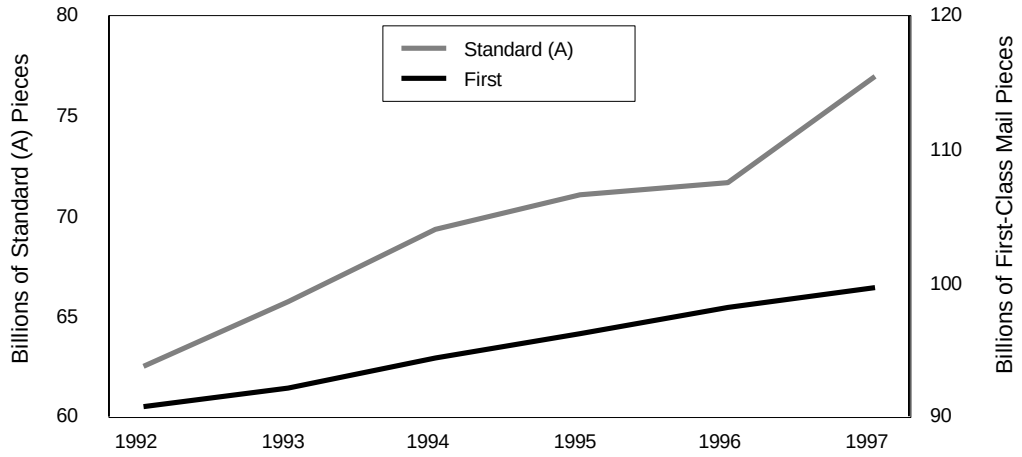

Exhibit 2.2. Standard (A) Mail Volumes by Year

Further, as illustrated in Exhibit 2.3, the annual rate of growth in First-Class Mail volume has slowed by 0.3 percent per year since 1983 (USPS 1996a). Explanations of this trend offered by postal experts - electronic diversion of bill presentation and payment, increased use of facsimiles and electronic mail, and reduced use of mail for personal communication - suggest that the decline in the growth rate for First-Class Mail will continue into the foreseeable future, increasing Standard (A) mail volume as a percentage of total mail volume.

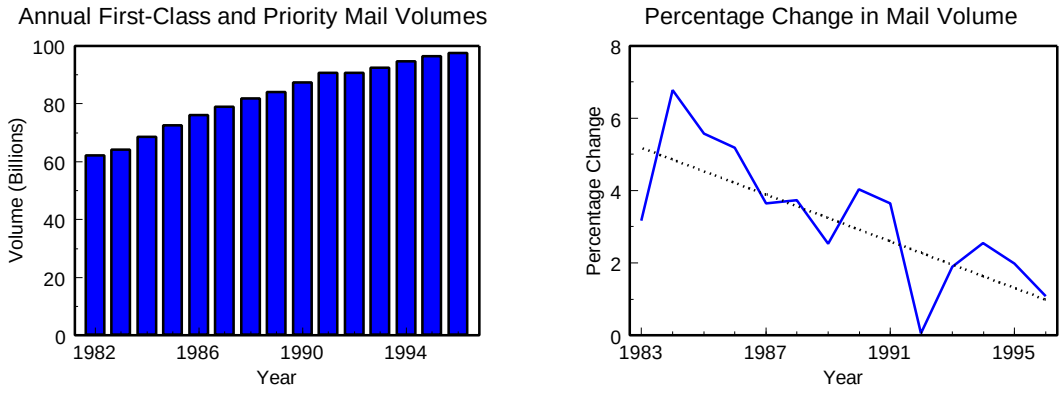

Exhibit 2.3. Annual Growth Rate of First-Class Mail Volumes

2.2. COMPOSITION AND USERS OF STANDARD (A) MAIL

The overwhelming majority of commercial Standard (A) mail consists of advertisements. In 1995, advertisements accounted for 90 percent of commercial Standard (A) mail received by households, up from 80.9 percent in 1987. Fund requests, newsletters, notifications, and announcements make up most of the remainder. As shown in Exhibit 2.4, the major users of commercial Standard (A) mail are merchants and financial institutions. From 1987 to 1995, mail order companies, publishers, department/specialty stores, and insurance and credit card companies accounted for more than half of all commercial Standard (A) mail received by households (USPS 1996b).

Exhibit 2.4. Major Mailers of Commercial Standard (A) Mail to Households

Industry	1987	1994	1995
Mail Order	16.5%	21.3%	22.7%
Department/Specialty Stores	24.7%	22.0%	19.6%
Publishers	13.9%	14.1%	13.3%
Financial Institutions	9.4%	8.9%	9.0%
Other	35.6%	33.7%	35.4%
Total Received by Households	**100.0%**	**100.0%**	**100.0%**

The composition of nonprofit Standard (A) mail differs somewhat from that of commercial Standard (A) mail: fund requests are the largest portion of nonprofit mail. Specifically, fund requests accounted for 42 percent of nonprofit Standard (A) mail in 1995 while advertisements made up 31 percent of volumes. Charities, educational and religious institutions are the largest nonprofit users of Standard (A) mail, accounting for about 50 percent of all nonprofit Standard (A) mail sent in 1995. Medical facilities, professional and political organizations, veterans organizations, and museums constitute the bulk of the remainder (USPS 1996b).

2.3. HOUSEHOLD PERCEPTION OF STANDARD (A) MAIL

Standard (A) mailers target certain portions of the population in a number of ways. For instance, because previous mail order purchasers are seen as more likely to purchase again, they receive more Standard (A) advertisements than households who have never made a purchase from the mailer. In 1995, households that had made no mail order purchases in the previous year received an average of 7.9 pieces of Standard (A) mail per week, while households that made 11 or more mail order purchases received 17.7 pieces per week (see Exhibit 2.5).

Exhibit 2.5. Standard (A) Mail Received by Number of Mail Order Purchases Made in Past Year (Pieces per Household per Week)

Mail Order Purchases	1987	1994	1995
0	7.5	7.6	7.9
1	9.5	8.7	9.8
2	9.5	9.9	9.8
3-5	10.8	11.3	11.8
6-10	13.8	13.6	14.4
11+	15.2	18.1	17.7

Further, as the amount of commercial Standard (A) mail grows, it is becoming more targeted. From 1987 to 1995, the percentage of mail received by previous customers of the sending company increased from 48 to 54 percent. Over the same period, mail received from an unfamiliar sender decreased from 18.1 to 11.6 percent (USPS 1996b).

Standard (A) mail is also received favorably by most households that receive it. Approximately 73 percent of commercial Standard (A) mail received by households in 1995 was read or looked at, up from 68 percent in 1987 (USPS 1996b). Further, only 15.9 percent was immediately discarded. For previous customers of the mailer, the percentage read or looked at in 1995 was even higher – about 86 percent.

Finally, the majority of Standard (A) mail is found useful or interesting. In 1995, 62.7 percent of commercial Standard (A) mail received by households was deemed "Useful" or "Interesting", while 29.2 percent was found "Not Interesting" or "Objectionable" (USPS 1996b). Again, previous customers are more likely to find Standard (A) mail useful or interesting (83 percent) than those to whom the mailer is unknown (34 percent).

3.0 ENVIRONMENTAL COSTS OF DIRECT MAIL

One environmental cost of direct mail occurs when individuals dispose of it.[1] Upon entering the municipal waste stream, discarded mail imposes a social cost that is borne directly by municipal governments and indirectly by taxpayers. This section describes our methodology for determining the social cost of transporting, incinerating and landfilling ("managing") Standard (A) mail that is not recycled or composted ("recovered"):

- **Section 3.1** describes the composition of the municipal solid waste (MSW) stream.

- **Section 3.2** provides information on the average fee charged for managing solid waste and the social cost of disposing this waste.

- **Section 3.3** derives the social cost of managing Standard (A) mail.

3.1 COMPOSITION OF MUNICIPAL SOLID WASTE STREAM

Although Standard (A) mail accounts for over 39 percent of Postal Service mail volume, it represents a much smaller portion, 2 percent, of MSW. Glass, metals, plastics, textiles, food wastes, and yard trimmings account for larger portions of the MSW stream than Standard (A) mail. Exhibit 3.1 shows MSW generation in the U.S. from 1990 to 1995 by material type (EPA 1996a).

Exhibit 3.1. Municipal Solid Waste Generation (Millions of Tons)

Waste Type	1990	1991	1992	1993	1994	1995
Other Paper/Paperboard	68.9	67.3	70.7	73.4	76.4	76.9
Yard Trimmings	35.0	35.0	35.0	33.3	31.5	29.8
Plastics	17.1	17.7	18.4	19.0	19.3	19.0
Metals	16.6	16.6	16.1	16.0	16.2	15.9
Wood	11.9	12.1	13.0	13.5	14.4	14.9
Food Wastes	13.2	13.7	13.6	13.7	13.9	14.0
Glass	13.1	12.6	13.1	13.6	13.4	12.8
Textiles	5.8	6.1	6.6	6.8	7.3	7.4
Rubber & Leather	5.8	5.9	5.8	5.7	6.2	6.0
Other	6.1	6.3	6.4	6.5	6.8	6.8
Standard (A) Mail	*3.8*	*3.7*	*3.6*	*4.0*	*4.4*	*4.6*
Total	**197.3**	**196.9**	**202.2**	**205.4**	**209.6**	**208.1**

Also, Standard (A) mail accounts for a much smaller portion of municipal solid waste generation than many other paper and paperboard products. As Exhibit

[1] We did not examine the environmental costs from producing paper on the theory that the EPA has promulgated regulations that adequately protect the environment.

3.2 illustrates, corrugated boxes, newspapers, office papers, and other commercial printing all make up larger portions of MSW than does Standard (A) mail. In 1995, Standard (A) mail accounted for only 6 percent of paper and paperboard products in the municipal solid waste stream (EPA 1996a).

Exhibit 3.2. Paper and Paperboard Products in MSW (Millions of Tons)

Product Category	1990	1991	1992	1993	1994	1995
Corrugated Boxes	24.0	24.1	25.4	26.7	28.1	28.8
Newspapers	13.4	12.5	12.7	12.9	13.7	13.1
Other Commercial Printing	4.5	4.7	5.5	6.5	6.1	7.1
Office Papers	6.4	6.3	6.7	6.6	7.0	6.8
Folding Cartons	4.3	4.6	4.6	4.9	5.2	5.3
Standard (A) Mail	*3.8*	*3.7*	*3.6*	*4.0*	*4.4*	*4.6*
Other	12.5	11.4	12.3	11.9	12.0	11.2
Total	**68.9**	**67.3**	**70.7**	**73.4**	**76.4**	**76.9**

In recent years, municipalities have made substantial progress in recovering Standard (A) mail from the MSW stream. From 1990 to 1995, the recovery rate for Standard (A) mail rose from 5.2 to 15.4 percent, an increase of almost 200 percent (EPA 1996a). In comparison, the average recovery rate for all other paper and paperboard products increased only 43 percent over the same period. For all municipal solid waste, the average recovery rate increased 57 percent, from 17.2 to 27.0 percent. While Standard (A) mail is currently recovered less often than other forms of municipal solid waste, its recovery rate is growing rapidly. If this trend continues, the environmental cost of Standard (A) mail will be smaller than estimated in this report.

Municipalities incinerate approximately 20 percent and landfill approximately 80 percent of waste that is not recovered (EPA 1996a). Applying these proportions to Standard (A) mail, we find that, in 1995, about 862,000 tons of Standard (A) mail (19 percent of Standard (A) mail) were incinerated and 3 million tons were landfilled (66 percent). If the recovery rate had not increased from 1990 levels, the percentage of Standard (A) mail disposed in landfills would have been 74 percent and the amount of waste incinerated 21 percent. Exhibit 3.3 shows the amount of Standard (A) mail in the MSW stream in 1995.

Exhibit 3.3. Standard (A) Mail in the MSW Stream by Management Strategy (Thousands of Tons)

	1990	1991	1992	1993	1994	1995

Generated	3,820	3,690	3,560	4,000	4,400	4,620
Recovered	200	330	350	440	690	710
Incinerated	707	703	653	730	765	862
Landfilled	2,913	2,657	2,557	2,830	2,945	3,048

3.2 WASTE MANAGEMENT COST

According to a recent issue of "Solid Waste Digest," the average fee charged by landfill and incineration facilities nationwide is currently $37 per ton (Chartwell 1997). This fee, commonly known as a "tipping fee," varies by location and disposal method. As illustrated in Exhibit 3.4, solid waste disposal in the northeast, where it costs $60 per ton, is more expensive than waste disposal in other regions. Also, incinerating waste is more expensive than landfilling it. The average fee for incinerating a ton of solid waste, $55, is much higher than the cost for landfilling it, $33. In the absence of data regarding the amount of Standard (A) mail waste disposed by location and disposal method, we assume that the average cost for disposing Standard (A) mail is the nationwide average of $37 per ton.

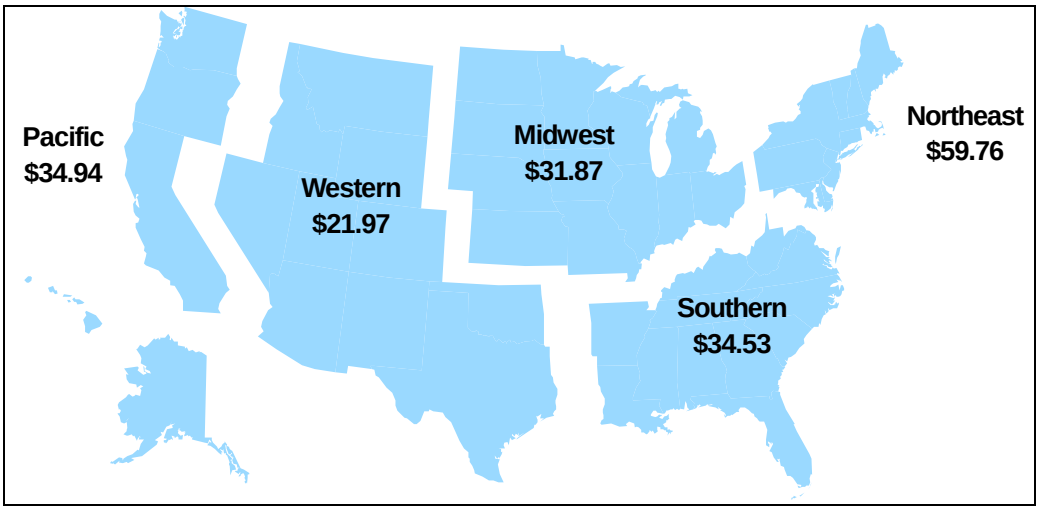

Exhibit 3.4. Average Tipping Fee per Ton by Region

The tipping fee must be adjusted to reflect the true environmental cost of Standard (A) mail waste disposal. The primary reason for this adjustment is that the tipping fee reflects average disposal cost. The average cost is inappropriate because it includes fixed costs that must be incurred whether or not an additional unit of waste is disposed. For example, the costs of monitoring and reporting to regulatory agencies are essentially the same regardless of the volume of waste disposed.

The appropriate measure of the cost of disposing a ton of Standard (A) mail is its marginal cost – the extra cost caused by disposing one more ton of mail. Since the marginal disposal cost reflects only those costs that vary with the volume of waste disposed, it is always less than the average cost of disposal.

To estimate marginal cost in engineering projects, cost engineers have developed a rule-of-thumb, the six-tenths rule, which states that the marginal cost is approximately six-tenths the average cost: in other words, disposal costs increase by 0.6 percent for every one percent increase in disposal volume (Ostwald 1992; AACE 1992). Applying this rule to the $37 per ton tipping fee yields a marginal cost of $22.20 per ton of solid waste disposed.

Tipping fees do not include the cost of transporting solid waste to the landfill or incinerator where it is subsequently disposed. Therefore, we calculate the cost of transporting Standard (A) mail in the MSW stream to disposal facilities separately from marginal disposal costs. To do so, we compare the fees charged by transfer facilities to tipping fees charged by disposal facilities. Transfer facilities receive solid waste from external sources, process and package it, and transport it to landfills and incinerators for disposal. The difference between the fees charged by transfer facilities and tipping fees at disposal facilities reflects the additional processing and transportation costs incurred by the transfer facility.

According to a recent issue of "Solid Waste Digest," the average fee charged by transfer facilities per ton of waste is $49.50 (Chartwell 1997). This is $12.50 per ton higher than the average tipping fee charged by disposal facilities. Even assuming the entire difference is attributable to transportation costs, the marginal transportation cost will be less than $12.50 per ton for the same reasons as those outlined above. According to the USPS, approximately 79 percent of Postal Service purchased transportation expenses vary with the volume transported (USPS 1996b). Applying this volume variability estimate to the transportation premium charged by transfer facilities, we obtain a marginal transportation cost for MSW of $9.93 per ton. When combined with the marginal cost of disposal of $22.20 per ton, we calculate a total marginal cost of $32.13 per ton of waste.

3.3 TOTAL ENVIRONMENTAL COST OF DIRECT MAIL

In Sections 3.1 and 3.2, we estimated the amount of Standard (A) mail disposed annually and the marginal cost of transporting and disposing one ton of solid waste. With this information, we can estimate the annual cost of managing

Standard (A) mail in the MSW stream. In Section 3.1, we calculated that municipalities disposed 3.9 million tons of Standard (A) mail in 1995. At $32.13 per ton, this yields an incremental cost of $125.6 million per year, or less than 0.2 cents per piece of Standard (A) mail.

4.0 ENVIRONMENTAL BENEFITS OF DIRECT MAIL

There are many benefits stemming from direct mail. Evidence of these benefits is the fact that consumers make a significant number of mail order purchases every year. Primary among these benefits are that direct mail often provides a wider selection of products and lower prices than are available at local stores. Also, direct mail offers the convenience of "shopping at home." Although these benefits may be large on their own accord, this report focuses only on the environmental and associated benefits from reducing the number of annual shopping trips.

Direct orders from catalogs[2] are substitutes for shopping trips typically made in automobiles; in other words, in the absence of direct mail, individuals would make more trips to purchase goods they would otherwise have purchased from a catalog. "Shopping at home" reduces the number of traffic accidents, the amount of pollution emitted by automobiles, and the amount of gasoline purchased per year.[3]

This section describes our methodology for estimating these benefits of direct mail and presents the results of our analysis:

- **Section 4.1** presents the annual number of orders made from catalogs, the number of shopping trips displaced by these orders, and the reduction in distance driven due to the catalog orders.

- **Section 4.2** quantifies and monetizes annual benefits from reducing the number of traffic accidents.

- **Section 4.3** quantifies and monetizes annual benefits resulting from the reduction in pollution.

- **Section 4.4** quantifies and monetizes annual benefits resulting from the reduction in gasoline consumption.

- **Section 4.5** summarizes the overall environmental benefits from direct mail.

[2] For simplicity's sake, we refer to all mail or phone orders from direct mail as catalog purchases.

[3] The mileage driven by a delivery service (e.g., USPS, FedEx) is negligible compared to the mileage an individual drives to a store because delivery services operate routes developed to minimize delivery cost. For this reason, we assumed that the environmental disamenities associated with increasing the number of items delivered are minimal.

4.1 DIRECT MAIL ORDERS / SHOPPING TRIPS

To estimate the benefits from reducing the number of shopping trips individuals make each year, we first undertook a four-step process to determine the reduction in the number of miles driven per year due to direct orders:

- Determine the number of catalog orders made per year;
- Estimate the number of trips displaced by these orders;
- Quantify the average distance driven per shopping trip; and
- Multiply the average distance per trip by the number of trips displaced to determine the mileage reduction due to catalog orders.

Number of Catalog Orders. In a market research study, Simmons Market Research found that, in 1996, approximately 109 million individuals purchased items from catalogs and that, on average, these individuals purchased 3 items in that year. Combined, this indicates that individuals made approximately 327 million catalog purchases in 1996 (DMA 1996; DMA 1997).[4]

Number of Trips Displaced per Direct Order. Shopping trips and catalog orders are close substitutes for each other. For example, if an individual wants to buy a J. Crew shirt, he could either order the shirt through J. Crew's catalog or drive to the nearest J. Crew store to buy the shirt. If the catalog option were unavailable, logic suggests that he would most likely buy the same, or a similar, shirt at the store.[5]

Although a mail order purchase is a close substitute for purchasing a similar item at a store, there is some uncertainty regarding the number of shopping trips that would substitute for one catalog order. For example, if catalogs provide more selection than is available at any one shopping location, an individual might have to make several shopping trips to make one purchase he would have made from a catalog. On the other hand, individuals could combine many purchases into one shopping trip. This scenario would result in replacing several catalog orders with one shopping trip.

In the absence of quantitative studies on this subject, we adopt the conservative assumption that three direct orders are required to displace one shopping trip.

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[4] The 1995 USPS Household Diary Study also provides data on household mail order purchases. Using these data along with Census Bureau information on the number of households in the U.S., we estimated a total of 336 million direct order purchases per year. Although similar to the figure of 327 million calculated above, we use the lower, more conservative figure in this analysis.

[5] Other options are that the individual would either not buy anything and save the money or buy another good. We assume that in the vast majority of cases if the catalog order option were unavailable, the individual would buy the item in a store because buying the same, or a similar, item in a store is the closest possible substitute for buying the item by catalog.

Appendix C provides a more detailed discussion of the effect of this assumption on our estimate of the total environmental benefit of fewer shopping trips.

Average Distance per Shopping Trip. We surveyed personnel at PPC to determine the average distance they travel to shop. We found that, on average, the individuals surveyed would travel approximately 20 miles round-trip to purchase items they typically purchase through catalogs. This probably underestimates the average distance of a shopping trip because the majority of individuals surveyed live in one urban area, the metropolitan Washington area, and most likely are closer than the average individual to stores. For this reason, our estimate of the total mileage reduction due to catalog orders is conservative. On the other hand, a small percentage of those surveyed, less than five percent, indicated that, although they would travel to a store, they would take public transportation. For this reason, our benefits estimate may be upwardly biased. We did not, however, correct for this bias because we think it is small and is overwhelmed by the downward bias resulting from only surveying urban individuals.

Mileage Reduction due to Direct Orders. As described above, individuals, in 1996, made approximately 327 million direct order purchases. Based upon the assumption that a shopping trip replaces three direct orders, direct mail replaces approximately 109 million shopping trips per year. At an average round-trip distance of 20 miles, direct mail reduced the number of miles driven in 1996 by 2.2 billion miles or approximately 0.09 percent of all miles driven in the United States in 1996.

4.2 REDUCTION IN TRAFFIC ACCIDENTS

The most direct benefit of reducing the number of shopping trips made in 1996 is the resulting decrease in traffic accidents. To quantify the magnitude of these benefits, we reviewed National Highway Transportation Safety Administration (NHTSA) data which indicated that, in 1996, traffic accidents resulted in approximately 42,000 fatalities, 3.5 million injuries, and $52.1 billion in property damage.

As described in Section 4.1, direct orders reduce the number of miles driven annually in the United States by 0.09 percent. Assuming that the number of traffic accidents is proportional to annual miles driven, direct orders yield significant accident reduction benefits:

Exhibit 4.1. 1996 Benefits of Traffic Accident Reduction

Source of Benefit	Value of Benefit
Fatalities	38
Injuries	3,159
Property Damage	$47 million

To facilitate a direct comparison of cost and benefits, it is necessary to determine the monetary value of the benefits. Although economists have many methods for doing this, the theoretical value of a benefit is simply the amount individuals are willing to pay for it. For market goods, economists often approximate a lower bound monetary value of a benefit (or good) as the price people pay in the market place for the good. This is a lower bound because people only buy goods when the amount they are willing to pay for the good is greater than or equal to the price of the good.

In this study, we use this technique to determine the monetary value of reductions in injuries and property damage. For injuries, we simply approximate the monetary value of injury reduction as the reduced medical cost ($4,850 per injury in 1994, according to the NHTSA). We also estimate the monetary value of property damage reduction as the reduced repair costs shown in Exhibit 4.1. The monetary value developed through this method is very conservative because it does not take into account pain and suffering, loss of work hours, or inconvenience.

Over the past two decades, EPA has commissioned studies to determine the monetary value of mortality reduction benefits (it is important to note that these studies do not value life, but only small changes in risks faced by large numbers of people). Researchers often express their findings in terms of a "statistical life." These studies indicate that individuals are willing to pay between $1 to $10 million to save a statistical life. A recent EPA study evaluating the costs and benefits of the Clean Air Act uses a value of a statistical life estimate of approximately $5 million (Fisher, et al. 1989; Scodari and Fisher 1988; EPA 1996b). Using the EPA value of $5 million per statistical life results in accident reduction benefits of $252 million.

Exhibit 4.2. Monetary Value of Traffic Reduction Benefits

Benefit	Quantity	Unit Benefit	Total Benefit
Fatalities	38	$5 Million per life	$190 Million
Injuries	3,159	$4,850 per accident	$15 Million
Property Damage	N.A.	N.A.	$47 Million
Total	**N.A.**	**N.A.**	**$252 Million**

4.3 AIR QUALITY IMPROVEMENT

Another benefit of reducing the number of miles driven is a reduction in the emission of pollutants and the resulting improvement in air quality. As illustrated in Exhibit 4.3, EPA has found that there are many adverse health effects resulting from pollutants that are emitted by automobiles (EPA 1997).

Exhibit 4.3. Adverse Health Effects From Automobile Emissions

Pollutant	Adverse Health Effects
Carbon Monoxide	Behavioral, developmental, and cardiovascular effects
Oxides of Nitrogen (NO_x)	Decreased pulmonary function, lung inflammation, and eye irritation
Lead	Cardiovascular diseases, IQ loss, adverse reproductive and developmental effects
Sulfur Dioxide (SO_2)	Respiratory effects
Particulate Matter	Decreased pulmonary function, chronic respiratory diseases, lung inflammation, chronic asthma

On-road vehicles are the single largest generators of carbon monoxide and NO_x (EPA 1996b). Also, although primary automobile emission of particulate matter makes up less than one percent of all particulate matter emissions, through chemical reactions, many automobile emissions transform into particulate matter, which is particularly harmful to human health (EPA 1996b; EPA 1997). Exhibit 4.4 shows primary emissions by source category.

Exhibit 4.4. 1995 Air Emissions (Millions of Tons)

Pollutant	Total Emissions	Vehicle Emissions	Percent of Total Emissions from Vehicles
Carbon Monoxide	92.1	58.6	63.7%
NOx	21.7	7.6	35.1%
Volatile Organic Compounds	22.9	6.1	26.7%
SO_2	18.3	0.3	1.7%
Particulate Matter (PM_{10})[1]	42.6	0.3	0.7%
Particulate Matter ($PM_{2.5}$)[2]	10.1	0.3	2.9%

[1]PM_{10} is particulate matter with aerodynamic diameter less than 10 microns.
[2]$PM_{2.5}$ is particulate matter with aerodynamic diameter less than 2.5 microns.

As described in Section 4.1, direct mail orders reduce the total number of miles driven annually in the U.S. by 0.09 percent. Exhibit 4.5 quantifies emission reductions by air pollutant assuming a linear relationship between miles driven and emissions. As expected, the largest reductions are in carbon monoxide and NO_x.

Exhibit 4.5. Reduction in Air Emissions (Thousands of Tons)

Pollutant	Reduction	Percent Change
Carbon Monoxide	52.7	0.06%
NOx	6.8	0.03%
Volatile Organic Compounds	5.5	0.02%
SO_2	0.3	0.00%
Particulate Matter (PM_{10})	0.3	0.00%
Particulate Matter ($PM_{2.5}$)	0.3	0.00%

In a recent EPA retrospective study of the benefits of the Clean Air Act, EPA noted that there is a strong association between ambient air concentrations of particulate matter and excess mortality: "There is substantial evidence that exposure to criteria pollutants, either individually or collectively, is significantly associated with excess mortality. This association is most closely and consistently related to the ambient air concentrations of PM" (EPA 1997, Page D-13). For this reason and because ambient air concentrations of PM are associated with a variety of emissions, the study "estimate[d] excess mortality (for all criteria pollutants other than lead) using PM as an indicator of the pollutant mix to which individuals were exposed." Because the gradual phaseout of lead from gasoline ended early in 1997, the benefits of reducing lead emissions from on-road vehicles are small or nonexistent (Bukro 1997).

Consequently, for air pollutants other than lead, we adopted EPA's approach for quantifying the mortality reduction benefits (For more detail on this approach, refer to Appendix A).[6] We first translated the reduction in automobile emissions due to direct mail into reductions in ambient concentrations of particulate matter. Using EPA's methodology, the reduction in automobile trips due to direct mail decreases ambient concentrations of particulate matter by .00181 mg / m^3 (SAI 1996a). We then estimated the number of statistical lives saved due to the improvement in air quality using EPA's methodology as represented in Equation 4.1.

[6] We focused on the mortality reduction benefits from exposure to particulate matter because these are the single largest quantifiable benefits from improved air quality. Because we did not focus on other air quality benefits, our estimate of air quality improvement benefits is conservative.

$$\Delta fatalities = fatalities \times (e^{b*.56*\Delta PM_{10}} - 1) \quad (4.1)$$

where $fatalities$ =Baseline fatalities from PM exposure

b =.006408

ΔPM_{10} = Change in ambient concentration of PM_{10} in mg / m^3

Equation 4.1 indicates that air quality improvements from direct mail save approximately 13 lives, a benefit valued at approximately $65 million.

4.4 REDUCTION IN GASOLINE CONSUMPTION

By reducing the number of miles driven for shopping purposes, direct mail orders also reduce national gasoline expenditures, saving consumers millions of dollars annually. In section 4.1, we found that direct orders reduce annual miles driven in the U.S. by 2.2 billion. According to the Bureau of Transportation Statistics (BTS), the average U.S. passenger car had a fuel efficiency of 22.6 miles per gallon in 1995.[7] Dividing the reduction in annual miles driven by miles per gallon yields a reduction in gasoline consumption of 97 million gallons per year. At a price of $1.25 per gallon of gas, annual savings from reduced gasoline consumption are $121 million.

Because the gasoline price "paid at the pump" includes tax (transfer payments from consumers to the government which are not costs to the society as a whole), the benefit to society from reducing gasoline consumption is somewhat lower. Excluding taxes from the price of gasoline yields a social cost per gallon of gasoline of $0.84 and an annual benefit from reducing gasoline costs of $81 million.

4.5 TOTAL ENVIRONMENTAL BENEFITS OF DIRECT MAIL

As detailed in Sections 4.2 through 4.4, the annual benefit from direct mail due to a reduction in annual miles driven is $398 million. On a per piece basis, this amounts to 0.6 cents. Exhibit 4.6 below disaggregates this benefit by source.

Exhibit 4.6. Summary of Environmental Benefits

[7] This is an upper bound estimate of fuel efficiency, since it excludes light-duty trucks, which are less efficient than passenger cars. The upper bound estimate of fuel efficiency yields a conservative lower bound estimate for the reduction in gasoline consumed due to direct mail and therefore a conservative estimate of the monetary value of this benefit.

Benefit	Source	Monetary Value
Fatalities	Traffic Accidents	$190 Million
Injuries	Traffic Accidents	$15 Million
Property Damage	Traffic Accidents	$47 Million
Fatalities	Particulate Matter	$65 Million
Gasoline Consumption	Miles Driven	$81 Million
Total		**$398 Million**

5.0 BENEFITS OF DIRECT MAIL JUSTIFY THE COSTS

The environmental benefits of direct mail far outweigh the environmental costs. We estimated that the social costs for managing Standard (A) mail solid waste are approximately $126 million per year. Our best estimate of the benefits of Standard (A) Mail is significantly higher, $398 million per year. This estimate is before analyzing other benefits of direct mail: wider selection, lower cost, and increased convenience. In fact, the monetary value of reducing traffic accident fatalities alone, $190 million per year, justifies the environmental costs.

Although further analysis regarding consumer behavior would shed additional light on the precise monetary value of the benefits of the proposal, under most reasonable assumptions regarding driving distances and the number of trips a catalog order displaces, the environmental benefits still outweigh the costs.

APPENDIX A. EPA METHODOLOGY FOR QUANTIFYING AND MONETIZING THE BENEFITS OF REDUCING AMBIENT CONCENTRATIONS OF PARTICULATE MATTER

As described in Retrospective Analysis of Particulate Matter Air Quality in the United States, "Particulate matter [measured by PM-10 in this study] is not a single atmospheric constituent, but rather is made up of a number of compounds... . The particulate matter species generally found in significant quantities in the atmosphere are crustal salts, organic and elemental carbonaceous aerosols, ammonium ions, sulfate ions, nitrate ions, water, and other trace metals... . The majority of ambient nitrates and sulfates are secondary in nature; they are formed in the atmosphere by the oxidation of nitrogen oxides (NO_x) and sulfur dioxide (SO_2), respectively." Similarly, some organic particulate matter is secondary in nature. Primary emissions of volatile organic compounds (VOCs) contribute to secondary formation of organic particulate matter.

For the retrospective analysis, EPA assumed that particulate matter concentrations, where no monitoring data were available, could be calculated using Equation A.1.

$$PM_{10} = S + N + O + P + (B_{>2.5} + B_{2.5}) \quad \text{(A.1)}$$

where

PM_{10} = total PM_{10} concentration
S = sulfate particulate concentration
N = nitrate particulate concentration
O = organic particulate concentration
P = primary particulate concentration
$B_{>2.5}$ = background concentration of $PM_{>2.5}$
$B_{2.5}$ = background concentration of $PM_{2.5}$

Further, EPA assumed that particulate matter "concentrations above background... increase or decrease linearly [strictly proportionately] with [corresponding primary] emissions." Exhibit A.1 lists the type of particulate matter and the median concentration in 1990, the corresponding primary emission and the percent reduction in emission due to direct mail, and the reduction in PM_{10} concentration due to direct mail.

Exhibit A.1. Reduction in PM Ambient Concentration of PM_{10}

PM Type	1990 Concentration [1]	Primary Emission	Percent Reduction in Primary Emission [2]	Change in Concentration [3]=[1]*[2]
Sulfate	7.8	SO_2	.0015%	.00012
Nitrate	.62	NO_x	.0314%	.00019
Organic	5.93	VOCs	.0240%	.00142
Primary	8.2	PM_{10}, $PM_{2.5}$	.0010%	.00008
Total	**N.A.**	**N.A.**	**N.A.**	**.00181**

[1] SAI 1996b, Table 4. Figures in mg / m^3

[2] Table 4.5.

Based upon a 1995 study of the relationship between mortality and ambient concentrations of particulate matter, EPA calculated the number of lives saved from reducing ambient concentrations of particulate matter using equation A.2 (EPA 1997, Page D-20). The fatalities used in this equation, 2 million, were total mortality in 1990 excluding accidental deaths and adverse effects, suicide, homicide, and other external causes (U.S. Department of Health and Human Services, 1994).

$$\Delta fatalities = fatalities \times (e^{b*.56*\Delta PM_{10}} - 1) \quad \text{(A.2)}$$

where $fatalities$ =Baseline fatalities from natural causes

b =.006408

ΔPM_{10} = Change in ambient concentration of PM_{10} in mg / m^3

Unlike EPA, we applied this equation at the national, rather than at the county level. Applying this equation at the national level indicates that reductions in miles driven due to direct mail orders save 13 lives annually.

APPENDIX B: PPC SURVEY TO ESTIMATE AVERAGE DISTANCE OF A SHOPPING TRIP

A key assumption underlying our analysis of the environmental benefits of direct mail is that the average roundtrip distance of a shopping trip is 20 miles. The benefits of direct mail order - reduced traffic accidents, automobile emissions, and gasoline consumption - necessarily vary with the distance the consumer would otherwise have driven to purchase an item through traditional shopping channels. In urban areas, one may not have to drive very far to find a particular good, whereas in rural areas, one may often have to drive great distances to obtain the same item. Given the complex demographic makeup of the United States and the great variation in consumer buying habits, there is some uncertainty regarding the distance people actually drive to purchase items they could have alternatively bought via direct mail catalogs.

To estimate the average distance of a shopping trip, we conducted a survey of PPC employees, in which respondents were asked to "think about the type of item that [they] buy most often by phone from a catalog. If [they] did not buy this type of item by phone, how far would [they] have to drive (one way) to a store to buy this type of item?" Respondents were then presented with several possible responses: 1, 2, 5, 10, 20, or 30 miles. We received a total of 49 responses, with a mean response of 9.7 miles (one way). Both the median and the mode responses were 5 miles, while the 25th and 75th percentiles were 5 and 10 miles, respectively. Exhibit B.1 shows the distribution of responses.

Exhibit B.1. Distribution of Survey Responses

One-Way Distance	Round-Trip Distance	Number of Responses
1	2	4
2	4	5
5	10	16
10	20	13
15	30	2
20	40	5
30	60	4

APPENDIX C: SENSITIVITY ANALYSIS OF ASSUMPTIONS UNDERLYING CALCULATION OF BENEFITS

Two primary assumptions underlie our analysis of the environmental benefits of reduced shopping trips attributable to direct mail order purchases. The first concerns the average distance driven per shopping trip (see Appendix B for a more detailed discussion of our methodology for estimating the average distance of a shopping trip).

The second assumption relates to the number of direct mail orders required to displace a shopping trip. Because people sometimes combine multiple purchases into a single shopping trip, a mail order purchase may not replace an entire shopping trip. Furthermore, some items purchased via direct mail order might not be available through normal distribution channels; in these cases, an individual might not make a trip to the mall to purchase the item because it was available only through mail order. On the other hand, some people prefer to "shop around" and may make several trips before deciding on a purchase. This wide variety of consumer responses results in much uncertainty regarding the substitutability of mail order purchases and shopping trips.

To assess the robustness of our results, we tested the sensitivity of our finding - that the environmental benefits of direct mail are larger than the associated environmental costs - to changes in these two assumptions. Exhibit C.1 displays the results of this sensitivity analysis. Although the benefits of reduced traffic accidents, automobile emissions, and gasoline consumption do vary with the number of shopping trips displaced and the average distance of each trip, the total environmental benefits of direct mail outweigh the associated environmental costs - $126 million - under most sets of assumptions.

Exhibit C.1. Total Benefit of Reduced Shopping Trips Attributable to Direct Mail ($ Millions[1])

Orders to Displace One Shopping Trip	Number of Miles per Shopping Trip (Round-Trip)			
	2	**10**	**20**	**40**
1	119	**596**	**1,194**	**2,391**
1.5	79	**397**	**795**	**1,592**
2	60	**298**	**596**	**1,194**
2.5	48	**238**	**477**	**955**
3	40	**199**	**397**	**795**
3.5	34	**170**	**341**	**682**
4	30	**149**	**298**	**596**
4.5	26	**132**	**265**	**530**
5	24	119	**238**	**477**

[1] Cells in bold indicate that environmental benefits are larger than environmental costs.

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